

REMARKS

A. Introduction

In this Office Action, claims 9-15 are noted as pending and are rejected based on prior art.

In summary of this Response, claims 9 and 14 are amended, new claims 16, 17 are added to afford a differing scope of protection for the invention to which the applicant is entitled, and remarks are provided.

B. Summary of the Invention

The following summary is presented to assist the Examiner in examining the subject application, but is not intended to limit the claims to the summary presented.

In general, it has been known that a highly-fluorinated polybenzoxazole (PBO) exhibits a desirably low dielectric constant. But, such a highly-fluorinated PBO is also known to have undesirably low thermal and mechanical properties (of course, if the fluorine content of the PBO is low, the mechanical properties of the PBO are known not to be low and, therefore, there is no necessity to improve the mechanical properties hereof).

In the present invention, the above-discussed thermal and mechanical deficiencies associated with highly-fluorinated PBO's have been unexpectedly overcome by introducing thermosetting reactive groups at both ends of the highly fluorinated PBO, resulting in a fluorinated PBO having a low dielectric constant as well as excellent thermal and mechanical properties. Thus, the thermally curable fluorinated o-aminophenol polymer or oligomer according to the present invention provides a dielectric film having: (1) a low dielectric constant; and (2) excellent thermal and mechanical properties because of the high fluorine content and the existence of the thermosetting reactive groups at both ends that undergo crosslinking reaction upon heating.

C. Rejection of Claims Under 36 U.S.C. §103

Claims 9-15 are rejected as being made obvious by the combination of Murayama et al.,

and Smith et al. Murayama et al. is relied upon for teaching the use of a similar fluorinated o-aminophenol polymer, but without end caps, for which Smith et al.'s "thermosetting end groups" are cited. The alleged motivation to add the Smith et al. end caps to the Murayama et al. PBO's is to provide low water sorption and high thermal strength.

Claims 9-15 are separately rejected based on a combination of Sezi et al., Smith et al., and Murayama et al. The former is cited for teaching a PBO, but like Murayama et al., lacking thermosetting end caps. Smith et al. is again relied on for the end caps, and Murayama et al. appears to be relied upon for the multilayered circuit board, where necessary.

In response thereto, it is respectfully submitted that the present invention, as recited by claims 9-17, was not made obvious by the cited prior art for the following reasons.

Murayama et al. discloses that fluorinated PBO's are synthesized from fluorinated o-aminophenols and fluorinated aromatic dicarboxylic acids. However, if the fluorine content in the monomers is high, especially if both the monomers contain highly-fluorinated groups, it is known to be very difficult to synthesize PBO polymers with sufficiently high molecular weights due to the low nucleophilicity of the fluorine-containing monomers. This results in PBO polymers of poor mechanical properties such as tensile strength. Moreover, where the polymers having high fluorine content are cured, the cured polymers are solvent susceptible and therefore it is extremely difficult to apply these polymers in multilayer circuit boards.

With the present invention, in order to obtain mechanically strong, solvent-resistant fluorinated PBO polymers with low dielectric constant, the precursors of the fluorinated PBO polymers are end capped with thermosetting reactive groups. As acknowledged by the Examiner, Murayama et al. fails to disclose or teach such end-capping.

Sezi et al. discloses that the fluorinated PBO's are synthesized from fluorinated o-aminophenols and fluorinated aromatic dicarboxylic acids. However, as in Murayama et al., Sezi et al. neither teaches nor suggests the introduction of the thermosetting reactive end groups into the fluorinated PBO polymers. Again, the Examiner appears to agree with this conclusion. Accordingly, the fluorinated PBO polymers of Sezi et al. should inevitably exhibit the same defects as mentioned above with respect to those of Murayama et al.

Smith et al. describes only very generally PBO's. However, Smith et al. neither teaches

nor suggests that end capping groups are introduced into a PBO polymer based on an aminophenol compound and an aromatic dicarboxylic acid compound, both of which are poly-fluorinated for lowering the dielectric constant, in order to improve mechanical properties. In this connection, note again that if the fluorine content is low, as in Smith et al., the mechanical properties of the fluorinated PBO polymers are not low and, therefore, there is no necessity to improve the mechanical properties of the fluorinated PBO polymers. That is although Smith et al. teaches the introduction of end capping groups into a PBO polymer, Smith et al. neither teaches nor suggests to one of ordinary skill the improvements of mechanical properties of the PBO polymer by the introduction of the end capping groups. With no need to improve the mechanical properties, there is no motivation to end-cap the polyfluorinated compounds of the primary references.

CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that claims 9-17 are now in condition for allowance.

If there are any additional fees associated with this Response, please charge same to our Deposit Account No. 19-3935.

Finally, if there are any formal matters remaining after this Response, the undersigned would appreciate a telephone conference with the Examiner to attend to these matters.

Respectfully submitted,

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